Arsenic in Groundwater in Central Illinois

Illinois Department of Natural Resources April 2005

The Mahomet and Glasford Aquifers provide nearly 700,000 central Illinois residents with drinking water. Arsenic occurs naturally in many areas of both these sand-and-gravel aquifers at concentrations greater than the new federal drinking water standard of 10 micrograms per liter (µg/L). When that standard takes effect in 2006, many public water systems will need to install additional treatments to meet it. Domestic wells are not subject to water-quality regulations, but some testing suggests that those wells may be even more susceptible to arsenic contamination than public supply wells.

If ingested at high concentrations (above 100 µg/L), arsenic can cause serious dermatological conditions; affect the respiratory, gastrointestinal, cardiovascular, and nervous systems; and also has been linked to various forms of cancer. Such severe health effects have occurred in South Asia, Taiwan, and elsewhere in the world where arsenic levels are very high. These levels are not typically found in Illinois.

Figure 1 shows the location of the Mahomet Aquifer, which occupies an ancient buried river valley that extends from Indiana to the Illinois River. Above most of the Mahomet Aquifer lies the much thinner, more spatially variable Glasford Aquifer, an important water source for domestic well owners and some communities.

Arsenic is a minor constituent of some common minerals, and dissolved arsenic concentrations commonly exceed 1 µg/L in groundwater. Most arsenic in aquifers is associated with iron minerals. Arsenic may enter groundwater when microorganisms in the subsurface dissolve those minerals. This is most likely to occur in areas containing large amounts of buried organic matter.

The Research

Illinois State Water Survey (ISWS) scientists collected water samples from nearly 200 domestic and public supply wells in both aquifers for analyses of arsenic and other substances between 2000 and 2003. Those results, and previously collected data from approximately 400 domestic and public supply well samples, were used to characterize the spatial distribution of arsenic and deter-mine what controls the amount of arsenic in groundwater.

Elevated arsenic concentrations (Figure 2) are as likely to be found in the shallow Glasford Aquifer as in the Mahomet Aquifer. There are two primary areas of

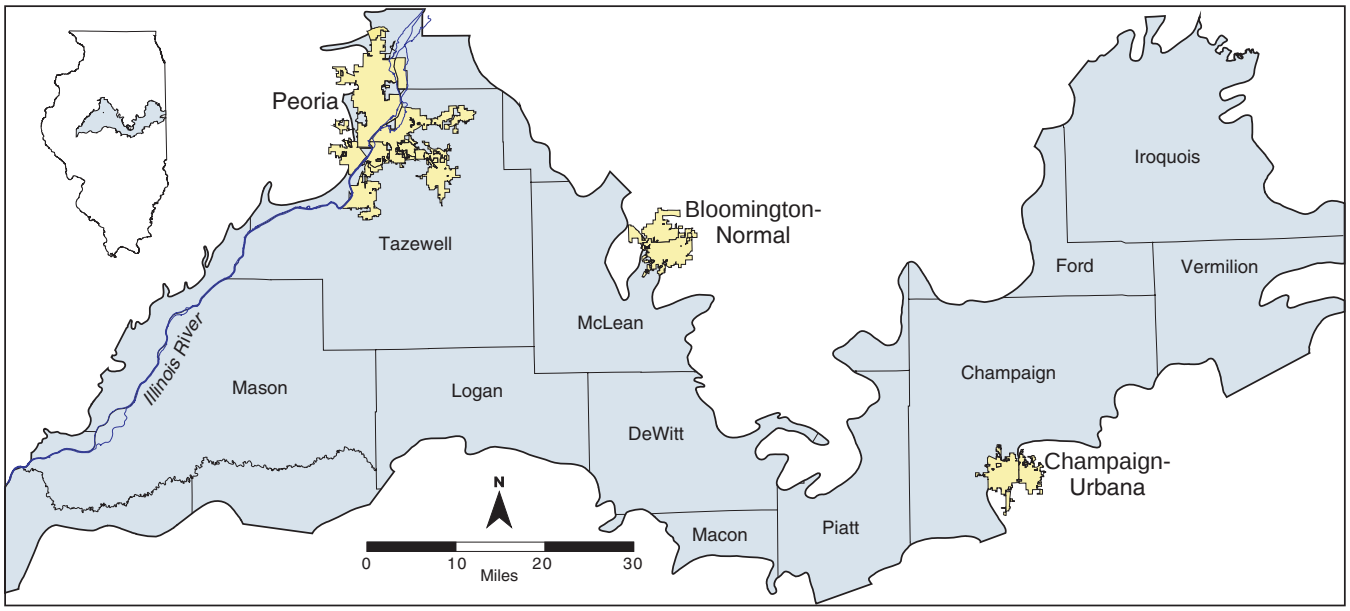

Figure 1. The Mahomet Aquifer region of central Illinois

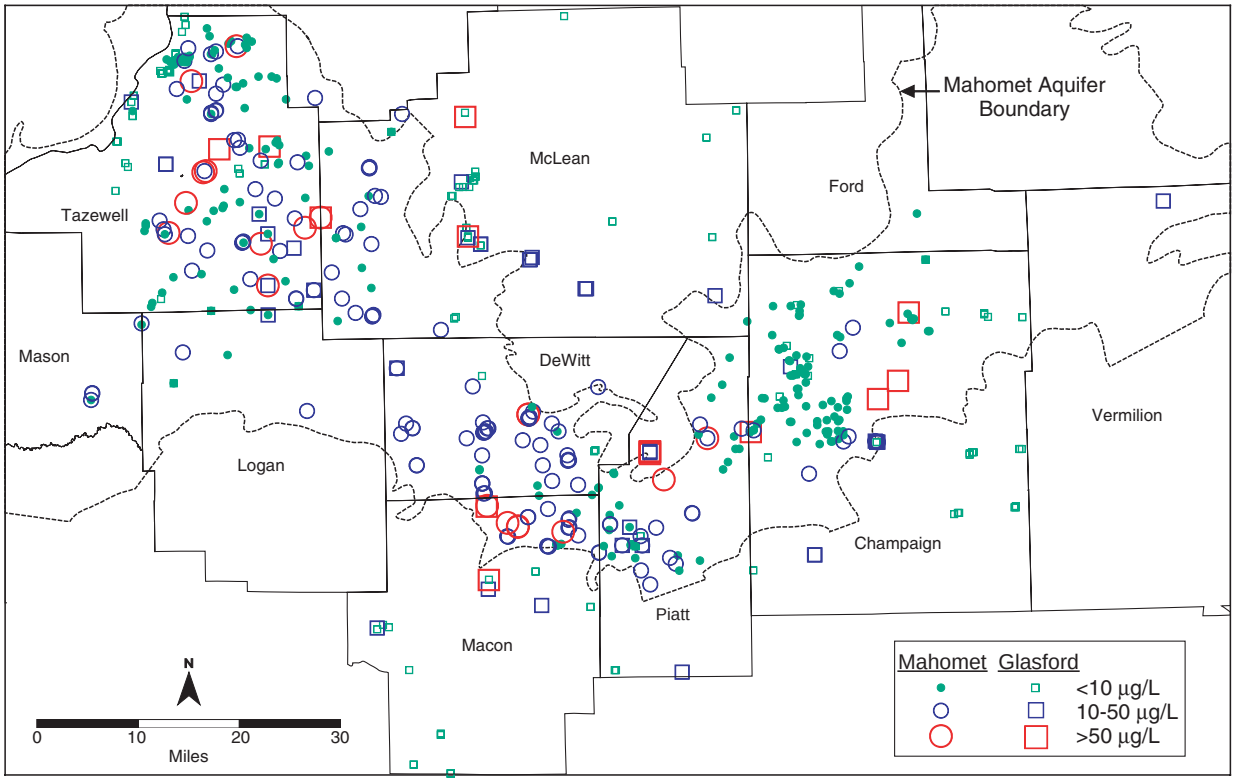

Figure 2. Arsenic concentrations in the Mahomet and Glasford Aquifers

elevated arsenic concentrations in the Mahomet Aquifer: Tazewell County (western part of the aquifer) and deep parts of the aquifer along bedrock valley walls in Piatt, DeWitt, and Macon Counties (central part of the aquifer). On the other hand, wells in the Glasford Aquifer having elevated arsenic concentrations are found throughout the study area. There is considerable spatial variability in the arsenic concentrations in both aquifers: wells less than a mile apart frequently have significantly different arsenic concentrations.

Geochemical conditions control arsenic concentrations. For example, arsenic concentrations are low in wells also containing sulfate, and high only in wells where sulfate is absent or at very low concentrations. Wells containing elevated arsenic concentrations also often contain methane and high organic carbon and ammonium concentrations.

Recommendations

Although elevated arsenic concentrations are more likely to occur in the western and central parts of the Mahomet Aquifer, more specific predictions cannot be made. The ISWS is encouraging well owners to submit samples for arsenic analysis. This recommendation is especially for Mahomet wells in Tazewell, Piatt, DeWitt, and Macon Counties and all Glasford wells. If testing detects high concentrations of arsenic in samples submitted, the well owner can drink bottled water or install a point-of-use treatment device. For example, water softeners that remove iron sometimes also remove arsenic.

More information about arsenic in the Mahomet and Glasford Aquifers and other parts of Illinois can be found at the ISWS Center for Groundwater Science Web page (sws.uiuc.edu/gws/) and in the following report: Holm, T.R., et al. 2004. *Arsenic Geochemistry and Distribution in the Mahomet Aquifer, Illinois.* Illinois Waste Management and Research Center Research Report 107, Champaign, IL (wmrc.uiuc.edu).

For further information about the research reported in this fact sheet, contact Walt Kelly (217-333-3729, kelly@sws.uiuc.edu) or Steve Wilson (217-333-0956, swilson@sws.uiuc.edu).

Water-Quality Analyses

The ISWS provides water-quality analyses for owners of domestic wells free of charge. If you would like to have your well tested, contact Brian Kaiser, ISWS PSL (217-333-0802; briank@sws.uiuc.edu).